Acumen Instruments Corporation

DataBridge SDR

User's Manual

revision 1.2 • 2/99

Copyright

Disclaimer

This manual has been thoroughly reviewed for accuracy, and every effort has been made to ensure that the information is accurate and complete. However, different versions of this product have different features and capabilities, and this manual only reflects one of those versions. Therefore, Acumen Instruments Corporation assumes no responsibility for errors, omissions or defects in this material, and shall not be liable for any damages resulting from their use.

The information in this document is subject to change without notice.

ACUMEN INSTRUMENTS CORPORATION MAKES NO WARRANTY OF ANY KIND WITH RESPECT TO THIS DOCUMENT, EITHER EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Table Of Contents

Getting Started 1

1.1 Overview 1
1.2 Before you start 2
1.3 A quick guide to DataBridge SDR 2
1.4 Deploying DataBridge SDR 3
1.4.1 Connecting the power supply and serial cables to your data recorder 3
Locating your computer's serial port 4
1.4.2 Communications software 5

Configuring DataBridge SDR 7

2.1 Setting date and time 8
2.2 Setting data port baud rate 9
2.3 Data port handshaking 9
2.4 Specifying a filename 9
Notes about filenames 10
2.5 Entering messages 10
Setting message parameters 11
2.6 Testing your configuration 12

Operating DataBridge SDR 13

3.1 Stop mode 13
3.2 Record mode 13
3.2.1 Receiving data 14
3.2.2 Power failure and improper shutdowns 14
3.2.3 Full storage media 14
3.2.4 Formatting the storage media 14
3.2.5 Partitions 14
3.2.6 Considerations for slow devices 15
3.3 Play mode 16
3.4 Real-time clock considerations 16

Configuration Menu Reference 17

4.1 Main Menu 17
4.2 Edit Messages 19
4.3 SCSI Drive Functions 19
4.4 File System Functions 21

DIP Switch Reference 25

5.1 Overview 25
5.1.1 Enabling data port handshaking (switch 1) 26
5.1.2 Enabling configuration port handshaking (switch 2) 26
5.1.3 Reserved switches (switches 3 and 4) 26
5.1.4 Displaying and hiding menus (switch 5) 26
5.1.5 Disabling buttons (switch 6) 26
5.1.6 Disabling indicators (switch 7) 26
5.1.7 Disabling resume mode (switch 8) 26
5.1.8 Initiator ID (switch 9) 27
5.1.9 Setting configuration port baud rate (switches 10-12) 27

Troubleshooting 29
6.1 Frequently Asked Questions (FAQ) 29

Service and Support 33
7.1 Contacting Acumen Instruments Corporation 33
7.1.1 Technical support..... 33
7.1.2 Mail 33
7.1.3 E-mail..... 34
7.1.4 World Wide Web..... 34
7.2 Returning Equipment 34
7.3 Warranty..... 34
7.3.1 One year warranty..... 34
7.3.2 Exclusions 34
7.3.3 Limitations..... 35

DataBridge SDR Evaluation Kit.....37
A.1 Overview 37
A.2 Front panel 38
A.2.1 Accessing DIP switches and RTC battery..... 38
A.3 Rear panel..... 39

Serial Port Basics.....41
B.1 Serial specifications 41
B.2 Data rates..... 41
B.2.1 Data rates and the UART 42
B.3 More asynchronous serial parameters..... 43
B.3.1 DTE and DCE..... 43
B.3.2 Handshaking 44
B.3.3 Voltage levels..... 45

DataBridge SDR Electrical Specifications.....47
C.1 Power requirements 47
C.1.1 Power receptacle pin configuration 48
C.2 Serial communications 48
C.3 SCSI interface 48

DataBridge SDR Mechanical Specifications 49
D.1 Dimensions 49
D.2 Environment..... 50
D.2.1 Desiccant 50

The Switch Closure Interface.....51
E.1 Description.....51
E.2 Operation.....51
E.3 Switch Closure Interface Data Format.....54
E.4 Schematic.....55
E.5 PCB Component Locations.....56
E.6 Bill of Materials.....57
E.6.1 Switch Closure Interface: Circuit Board.....57
E.6.2 Switch Closure Interface: Internal Cable Assemblies.....57
E.6.3 Switch Closure Interface: External Cable Assemblies.....58
E.7 Specifications.....58
E.7.1 Power Requirements.....58
E.7.2 Isolation.....59
E.7.3 Switch sampling rate.....59

1

Getting Started

1.1 Overview

The DataBridge Serial Data Recorder (SDR) is designed to record serial data to a SCSI mass storage device using a MD-DOS™/Windows™-compatible FAT file. An intuitive three-button user interface activates DataBridge SDR's Stop, Play and Record modes.

DataBridge SDR is equipped with two serial ports. With terminal software on a PC, you can use the *configuration port* to manage files, configure and communicate with the data port, set date and time, set up output messages, download data, configure the storage media, and enter Record and Play modes. During Record mode, you can also monitor recording using the configuration port.

During Record mode, the *data port* accepts RS-232C serial data from your data source. For data sources that require initialization or querying, DataBridge SDR can store and transmit up to ten user-defined messages. Each message is independent and can be sent once at power-up or periodically at specific intervals.

The *data source* is a device that transmits serial data for use by a computer, printer, or data logger.

DataBridge SDR's ports support baud rates up to 230,400 bps and hardware handshaking for reliable high-speed communication. DataBridge SDR is also equipped with a real-time clock, power-saving features, non-volatile memory, and resume-on-power failure feature.

1.2 Before you start

Before you start, be sure you have the following items available:

- The DataBridge serial data recorder (SDR)
- A power supply
- The DataBridge SDR dual serial cable
- The manual supplied with your computer or terminal

1.3 A quick guide to DataBridge SDR

DataBridge SDR's basic functions are controlled using the three buttons located on the front panel (see Figure 1.1). The indicators in the buttons indicate the DataBridge SDR's current operating mode (Stop, Play, Record). The *data indicator* indicates that data is received by DataBridge SDR and is used to verify proper function of the data recorder.

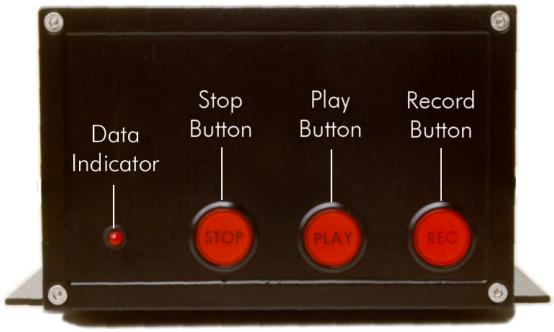


Figure 1.1. DataBridge SDR's front panel showing the location of the data indicator and Play, Stop, and Record buttons.

The power connector (see Figure 1.2) found on DataBridge SDR's back panel supplies 5 VDC and/or 12 VDC. The serial connector connects DataBridge SDR to your data source and (optionally) a PC running communications software. The SCSI connector is used for high-speed data downloads using a PC equipped with a SCSI adapter.

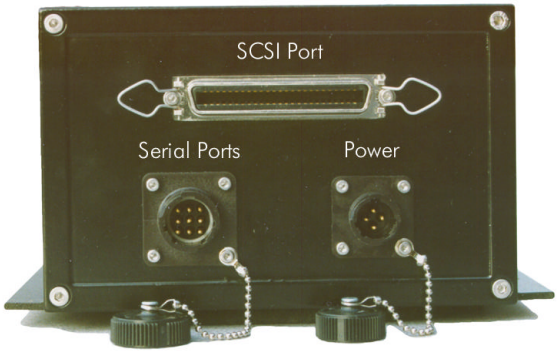


Figure 1.2. DataBridge SDR's rear panel showing the location of the serial ports and power receptacle.

1.4 Deploying DataBridge SDR

1.4.1 Connecting the power supply and serial cables to your data recorder

A cable that mates with the AMP Circular Plastic Connector (CPC) receptacle found on the rear panel is supplied with the DataBridge SDR. The cable's female DB9 connector mates with the male connector typically found on computers (and other DTE equipment). The cable's DB9 male connector mates with the port on your data source. Connect the AMP CPC plug to the corresponding receptacle on the DataBridge rear panel (see Figure 1.2), leaving the cable's DB9 connectors unconnected.

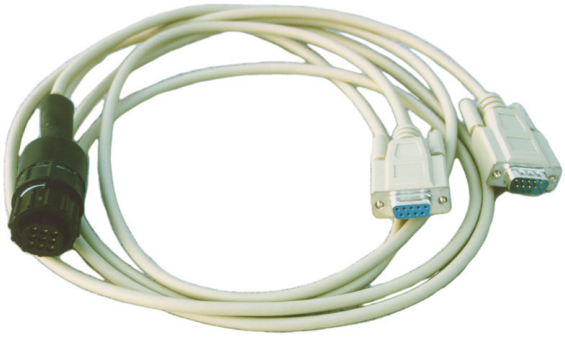


Figure 1.3. The DataBridge SDR dual serial cable.

Similarly, the power supply included with DataBridge SDR uses a 4-pin AMP CPC connector. Connect the power supply to DataBridge SDR, but leave the IEC cable (for 120 VAC power) unconnected.

Figure 1.4. A DataBridge SDR 120VAC power supply.

Locating your computer's serial port

Your computer's *female* DB25 connector is most likely a parallel port, not a serial port.

Your serial port is found on the back of your computer. Most computers are equipped with either a DB9 or DB25 male connector (see Figure 1.5). Male connectors have pins, while female connectors have sockets. If your computer uses a serial mouse, it may already occupy your DB9 male connector. Likewise, if your computer is equipped with an external modem, it may occupy your DB25 male connector.

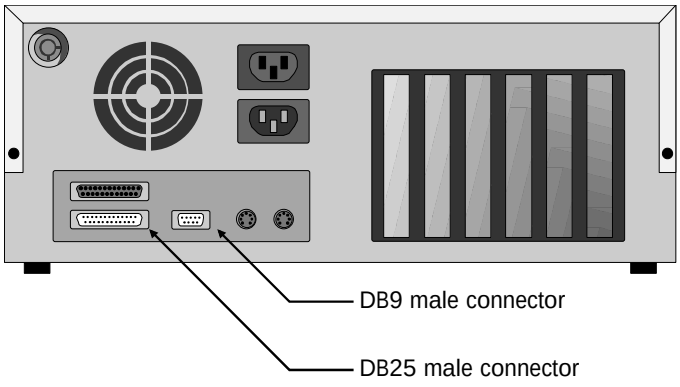


Figure 1.5. Locating the serial port on the rear panel of a PC.

If you are unable to locate your serial port(s), consult the documentation included with your computer. If all of your computer's serial port(s) are occupied, contact your manufacturer or support provider for information about adding a serial port to your computer.

If your computer is equipped with a DB9 male receptacle, connect the DataBridge SDR dual serial cable's DB9 female connector to your computer. If your computer's available serial port is a DB25 male connector, you will need to purchase a DB9M to DB25F adapter, often referred to as an AT adapter, to connect the 9-pin DataBridge SDR cable to your 25-pin serial port (the adapter has DB9 male and DB25 female connectors).

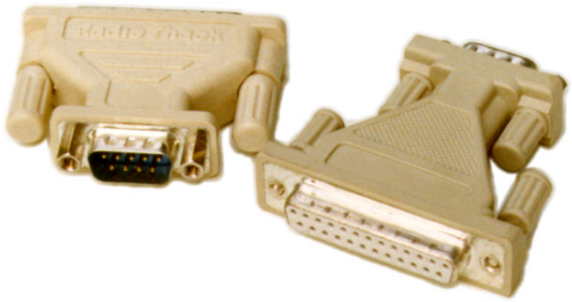


Figure 1.6. DB25 female to DB9 male adapters (AT adapter).

Once you have located your serial port, you need to know whether your port is configured for operation as COM1, COM2, COM3, or COM4 (some computers even include COM5-COM8). In most cases, a port that uses a DB9 male connector is configured as COM1 (or perhaps COM3), while a DB25 male connector is configured as COM2 (or COM4). If some of your computer's ports are occupied by a mouse, modem, serial printer, or other serial device, you may need to explore your computer's configuration information and use a process of elimination to determine your port's COM designation.

1.4.2 Communications software

Now that DataBridge SDR is connected to your computer, you must configure communications software (also known as terminal software) to communicate with it. Typical communications software includes: Procomm Plus™, Crosstalk™, and Telix™ (available for DOS users), Windows Terminal (included with Microsoft® Windows™ 3.1 and Windows NT 3.51), and HyperTerminal™ (included with Microsoft Windows 95/98/NT 4.0).

Configure your software to communicate using the serial port you connected to DataBridge SDR, the appropriate baud rate (probably 9600 bps), and the serial data format parameters (probably 8N1). See Section 0 if you need to

change DataBridge SDR's serial parameters to match your communications software.

Be sure your software is configured for half-duplex mode (local echo is off) and that your software isn't adding line feeds to incoming carriage returns. If your software supports it, enable ANSI or VT-100/VT-102 terminal emulation.

Once DataBridge SDR is connected to your computer and you are running terminal software, apply power by connecting the power supply's IEC cable to 120 VAC power. The DataBridge main menu should appear (see Figure 1.7).

```
Acumen Instruments Corporation            12/02/1998 14:20:30
DataBridge SDR firmware rev. 1.2b         Current filename is: BRIDGE01.DAT

 1  Set time
 2  Set date
 3  Toggle ANSI mode (ANSI is ON)
 4  Toggle messages (messages are OFF)

 5  Edit messages...
 6  SCSI drive functions...
 7  File system functions...

 8  Enter serial passthrough mode
 9  Set baud rate for attached device

 P  Enter PLAY mode
 R  Enter RECORD mode

Enter choice (1,2,3,4,5,6,7,8,9,P,R)
```

Figure 1.7. The DataBridge main menu.

2

Configuring DataBridge SDR

Now that you have access to DataBridge SDR's menu system, you are ready to configure it for use with your serial data source. To accomplish this you must:

- Set DataBridge SDR's date and time.
- Specify a filename for recording.
- Ensure that the media you are using is properly formatted and has enough free space to accommodate your data.
- Be sure that DataBridge SDR and your device are communicating at the same speed and with the same serial data format parameters.
- Determine whether you need to use hardware handshaking to communicate with your device.
- Connect your device to DataBridge SDR.
- Check to see that your data source can communicate with DataBridge SDR.

Before you begin, be sure you have the documentation available for your serial data source. If possible, be sure you can communicate with the data source using the supplied software and/or your communications software. This intimate knowledge of your data source's communications standards will make connecting it to DataBridge SDR simple.

2.1 Setting date and time

For more information about DataBridge SDR menus, see chapter 4.

DataBridge SDR features a real-time clock that reports the last modified date and time in a directory entry. The real-time clock is preset and battery-backed, so setting the date and time is seldom necessary.

To set the time, press **1** at the menu prompt. Then, when prompted further, enter the time in 24-hour format using two digits for each of hours, minutes, and seconds (omit the colons (**:**) between each field). Press any key to return to the DataBridge main menu. For an example, see Figure 2.1.

```
Acumen Instruments Corporation            12/02/1998 14:42:14
DataBridge SDR firmware rev. 1.2b         Current filename is: BRIDGE01.DAT

 1  Set time
 2  Set date
 3  Toggle ANSI mode (ANSI is ON)
 4  Toggle messages (messages are OFF)

 5  Edit messages...
 6  SCSI drive functions...
 7  File system functions...

 8  Enter serial passthrough mode
 9  Set baud rate for attached device

 P  Enter PLAY mode
 R  Enter RECORD mode

Enter choice (1,2,3,4,5,6,7,8,9,P,R) 1
Current time is 14:42:15
Enter new time (hh:mm:ss) 09:00:00
Time set to 09:00:00
Press any key to continue...
```

Figure 2.1. Setting the time.

To set the date, press **2** at the menu prompt. Then, enter the date using two digits for each of the month, day, and year fields (omitting any hyphens or other characters). Press any key to return to the DataBridge main menu. See Figure 2.2 for an example.

```
Acumen Instruments Corporation            02/05/1998 14:42:14
DataBridge SDR firmware rev. 1.2b         Current filename is: BRIDGE01.DAT

 1  Set time
 2  Set date
 3  Toggle ANSI mode (ANSI is ON)
 4  Toggle messages (messages are OFF)

 5  Edit messages...
 6  SCSI drive functions...
 7  File system functions...

 8  Enter serial passthrough mode
 9  Set baud rate for attached device

 P  Enter PLAY mode
 R  Enter RECORD mode

Enter choice (1,2,3,4,5,6,7,8,9,P,R) 2
Current date is 02/05/98
Enter new date (mm/dd/yy) 02/04/98
Date set to 02/04/98
Press any key to continue...
```

Figure 2.2. Setting the date.

2.2 Setting data port baud rate

DataBridge SDR uses a format of eight data bits, no parity, and one stop bit (8N1).

Before DataBridge SDR and your data source can communicate, they must interact at the same data rate and using the same data format.

DataBridge SDR's data port and configuration port are, by default, configured to communicate at 9600 bps.

If your data source can communicate at 9600 bps (also referred to as 9600 baud), it may be easiest to configure it for 9600 bps. For devices with a fixed data rate, you will need to set DataBridge SDR's data port baud rate to match your data source. You may also wish to choose a higher data rate (and hardware handshaking) if your data source sends a high volume of data.

To set the baud rate for the data port, press **9**, then select a baud rate from the displayed list (2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400 bps). Select a baud rate that matches the rate used by your data source. You can use Equation 2.1 to configure the data port for "nonstandard" baud rates like 7200 and 3600 bps.

$$divisor = \text{int}\left(\frac{7372750}{\text{desired baud rate in bps}}\right)$$

Equation 2.1. Equation for specifying an arbitrary baud rate divisor.

2.3 Data port handshaking

Hardware handshaking ensures that DataBridge SDR sends messages only when the data source is ready to accept them. Likewise, hardware handshaking prevents a data source from sending data when DataBridge SDR is not ready to receive it.

Remove DataBridge SDR's front panel (see Figure 5.1) and turn switch 1 on (see Table 5.1) to enable handshaking on the data port.

Be sure that your serial data source and DataBridge SDR use the same handshaking settings. If DataBridge SDR monitors the handshaking signal but your data source does not send it, DataBridge SDR may wait indefinitely for "permission" to transmit messages. Likewise, if your data source monitors the handshaking signals but DataBridge SDR doesn't send the signal, the software may never transmit output data.

2.4 Specifying a filename

DataBridge SDR records data to a file in the mass storage device's root directory. By default, DataBridge SDR records data to a file called

DataBridge SDR records and plays only files found in the root directory of the disk.

`BRIDGE.DAT`. You can keep this filename or specify a new filename that reflects the data it contains. For example, you may wish to use `PRESSURE.TXT` for pressure data or even a name like `TEMP0998.TXT` for temperature data from September 1998.

Notes about filenames

When you enter filenames, they must conform to the DOS 8+3 filename format. This means that files contain up to 8 characters, a period ("dot"), and up to three more characters. For example, `BRIDGE.DAT`, `ABCDEFGH.123`, and `1` are all valid filenames, while `DATA.FILE`, and `JOHNSMITH.TXT` are not. DataBridge SDR ignores characters you type that are not allowed in DOS filenames, such as: **\/*|[]**.

To specify the name of the file DataBridge will use for recording data, press **7** at the main menu prompt to enter the File System Functions submenu (see Figure 2.3).

From the File System Functions menu, press **2**. Then, when prompted, type a filename, pressing the **Enter** key when finished if your file extension is shorter than three characters. If your filename (without extension) is eight characters, DataBridge automatically enters the period ("dot") before the extension. You can return to the main menu by pressing **Q**.

```
Acumen Instruments Corporation
DataBridge SDR firmware rev. 1.2b          Current filename is: BRIDGE01.DAT

 1  Display root directory
 2  Change current filename
 3  Delete file
 4  Rename file
 5  Toggle append mode (append is ON)
 6  Download file via XMODEM
 7  Download file as ASCII text
 8  Set scheduled file close parameters (OFF)
 Q  Return to main menu

Enter choice (1,2,3,4,5,6,Q) 2
Enter new filename (<cr> to end): ABCDEFGH.123
```

Figure 2.3. Specifying a filename.

2.5 Entering messages

Some data sources need to receive specific data strings or commands before they will transmit data. Other data sources send data continuously once they are initialized with a specific string or command. If your device transmits data continuously without requiring input, you don't need to send output messages.

You can configure DataBridge SDR to send up to ten independent messages to the data source on startup, periodically, or both, on intervals from once/second to once/194 days.

Messages are stored as ASCII text strings in non-volatile memory. These storage locations are referred to as messages 0-9. To use messages, first enter a text string as one of the ten messages. Next, configure the message to be sent on initialization or at an interval specified in seconds. DataBridge SDR can also be configured to append a carriage return **<CR>** and/or line feed **<LF>** to any message.

To enter a new message, press **5** at the main menu prompt to enter the Edit Messages submenu. Then, press **1** to edit a message. When prompted, enter the desired message number (**0**-**9**) and type a message followed by the **Enter** key.

```
Acumen Instruments Corporation
DataBridge SDR firmware rev. 1.2b

#  interval  I  CR LF message contents
0  00000000  N  N  N
1  00000000  N  N  N
2  00000000  N  N  N
3  00000000  N  N  N
4  00000000  N  N  N
5  00000000  N  N  N
6  00000000  N  N  N
7  00000000  N  N  N
8  00000000  N  N  N
9  00000000  N  N  N

 1  Edit message contents
 2  Edit message parameters
 Q  Return to main menu

Enter choice (1,2,Q) 1
Enter message number (0-9): 0
Enter message(<cr> to end): ASTRAL
```

Figure 2.4. Changing message zero to "ASTRAL".

Setting message parameters

To change a message's parameters, press **2** at the menu prompt. When prompted, enter the desired message number (**0**-**9**) and type a message followed by the **Enter** key.

Output intervals: DataBridge sends a message, then waits a specific amount of time before sending the message again. DataBridge prompts you to enter this waiting period, or output interval. To disable a message (but leave its contents intact), enter **0**. For instance, if the message should be output once every ten seconds, enter **10** and press the **Enter** key.

Initialization: Some devices begin sending data only after receiving a specific command, the initialization string. When prompted, press **Y** to indicate that DataBridge SDR should send the message once when it enters Record mode. This feature can be used together with output interval to both initialize a device with a specific message and send the message periodically. This is useful for resetting a data source periodically or automatically

reinitializing a data source if its power is lost. Entering **N** disables this feature.

Carriage return and line feed: When prompted, enter **Y** when prompted to instruct DataBridge SDR to add a carriage return and/or line feed to the end of a message. Many devices require a carriage return and/or line feed after a message, while others require neither. Entering **N** disables this feature. Your data source's documentation can help you determine whether carriage returns and/or line feeds are required.

```
Acumen Instruments Corporation
DataBridge SDR firmware rev. 1.2b

#  interval  I  CR LF message contents
0  00000000  N  N  N
1  00000000  N  N  N
2  00000000  N  N  N
3  00000000  N  N  N
4  00000000  N  N  N
5  00000000  N  N  N
6  00000000  N  N  N
7  00000000  N  N  N
8  00000000  N  N  N
9  00000000  N  N  N

 1  Edit message contents
 2  Edit message parameters
 Q  Return to main menu

Enter choice (1,2,Q) 4
Enter message number (0-9): 0
Enter output interval in seconds (0-16777215): 10
Initialize with this message (Y/N)? N
Append carriage return to this message (Y/N)? Y
Append line feed to this message (Y/N)? Y
```

Figure 2.5. Configuring message zero.

2.6 Testing your configuration

To test your configuration, you can disconnect the configuration port plug and use a null modem adapter or cable to connect the dual serial cable's male DB-9 plug to the computer running communications software. Your computer then becomes a data source.

Messages with only a carriage return (no line feed) after them will appear to overwrite previous messages in your terminal software. You can enable your communications software's "append linefeeds to incoming carriage returns" feature to see these messages properly.

Press the Record button on the front panel. After a few seconds, DataBridge SDR's record indicator will light and the output messages you entered will be displayed at the specified output interval.

To ensure that recording is occurring, type several keystrokes on the computer running communications software or use the software's ASCII upload feature to send a text file. DataBridge SDR's data indicator should blink as you press keys. When finished, press the Stop button on the front panel. Then, press the Play button to view the data you typed or uploaded.

Note: DataBridge SDR will not display data while it is being recorded. You can enable your terminal software's "local echo" or "full duplex" feature to view data as you send it.

3 Operating DataBridge SDR

3.1 Stop mode

Stop mode is the default power up mode. When DataBridge SDR is in Stop mode, the Stop indicator is illuminated and you can access menu functions using communications software on a computer attached to the configuration port.

Before you connect your device, be sure DataBridge SDR is in Stop mode.

3.2 Record mode

When you press the Record button or type **R** from the main menu, DataBridge SDR searches for the file you specified in the File System Functions menu, creates it if necessary, and opens it. Once DataBridge SDR has successfully opened the file, the record indicator glows and DataBridge SDR enters Record mode.

Once in Record mode, DataBridge SDR transmits the messages stored in nonvolatile memory at the specified intervals to the data source connected to its data port.

3.2.1 Receiving data

Incoming data is appended to the open file as it is received until you press the Stop button. DataBridge SDR then closes the file, updates its directory entry (recording file size, date, and time), and returns to Stop mode.

The data indicator, found on DataBridge SDR's front panel (see Figure 1.1), flashes when the data source transmits data. This indicator is useful to ensure that DataBridge SDR is actually receiving data via the data port.

3.2.2 Power failure and improper shutdowns

If DataBridge SDR loses power while in Record mode, it returns to Record mode after power is restored. For troubleshooting, this feature is disabled by setting switch 8 to the on position (see Table 5.1).

An improper shutdown may result in loss of data (due to sector buffering and caching in the storage device) and minor allocation errors that can be repaired using the MS-DOS™ SCANDISK.EXE utility, Norton Disk Doctor™, or Windows 95/98/NT™ Explorer.

3.2.3 Full storage media

When the storage media's first valid partition is full, DataBridge SDR returns to Stop Mode.

DataBridge SDR ejects the disk if you are using removable media. You can delete files on the target media using your computer or replace it, then insert the media and press the record button and append data normally.

3.2.4 Formatting the storage media

If your storage media was included with DataBridge SDR, it is already formatted properly. Most preformatted media (such as Zip and Jaz disks) is also ready for use.

If you have purchased media for use with a removable mass storage device or you are installing a new storage device, you will need to format it using MS-DOS™, Windows 95/98™, Windows NT™, or another operating system that supports the FAT file system.

DataBridge SDR supports only the FAT file system. If your computer supports the NTFS, FAT32, HPFS, or other advanced file systems, be sure your disk is formatted using conventional FAT.

3.2.5 Partitions

In some cases, disks are partitioned to contain multiple "virtual" drives on a single disk. Partitioning is often done to overcome the 2 gigabyte size limit in MS-DOS™ (and create multiple 2 gigabyte drives), support multiple operating systems and file systems, or make more efficient use of disk space (by using a smaller cluster size).

FDISK.EXE (included with MS-DOS™ and Windows 95/98™), Disk Administrator (included with Windows NT™), Norton Disk Doctor™, and Norton DiskEdit™ are useful tools for managing and analyzing disk partitioning schemes.

DataBridge SDR supports both extended and primary FAT and VFAT partitions, but always reads and writes files in the first partition it recognizes as FAT or VFAT.

3.2.6 Considerations for slow devices

Mass storage devices, particularly low-power and removable devices, sometimes suffer from slow disk access times. It is important to note that access times quoted by manufacturers are averages. A worst-case access time can be ten times the number specified. For instance, a drive with a 25 millisecond average access time may sometimes require 250 milliseconds or more to access a sector.

DataBridge SDR includes a 224-byte character buffer to store characters received during slow disk accesses. The maximum disk access time before DataBridge SDR asserts its handshaking signalor characters are lost can be calculated using Equation 3.1.

$$t_{\max} \cong \frac{224\,\text{bytes}}{\text{average byte rate}}$$

Equation 3.1. Maximum disk access time.

The average byte rate for a serial data source that transmits data continuously given in Equation 3.2.

$$\text{average byte rate} = \frac{\text{bits}}{\text{second}} \times \frac{1\,\text{byte}}{10\,\text{bits}}$$

Equation 3.2. Average byte rate.

So, if a data source transmits data continuously at 9600 bps, the maximum disk access time is approximately 240 ms.

Most data sources transfer data in short bursts. For example, a device may send a 10-byte message once per second. In this case, the average byte rate is simply 10 bytes/second and the maximum disk access time becomes 22.4 seconds.

If your maximum disk access time exceeds your media's worst-case access time, you can expect occasional data loss.

Enable hardware handshaking on DataBridge SDR and your serial data source when possible to avoid data loss when using slow media.

3.3 Play mode

When you press the play button (while in Stop mode), DataBridge SDR attempts to find the specified file and open it. If it exists, DataBridge SDR enters Play mode and transmits data via the serial port for viewing, downloading using your communications software's ASCII download feature, or even simulating the serial device for use with its software. For example, you could record position data from a GPS receiver using DataBridge SDR, then use Play mode to plot the data with GPS-ready mapping software as if the receiver were connected to the computer.

Playback continues until DataBridge SDR reaches the end of the current file or you press the stop button. You can also hold the **Ctrl** key and press **C** (**Ctrl-C**) to stop data playback. Once DataBridge SDR reaches the end of the file, you must press the stop button to return to Stop mode. This gives you the opportunity to stop your ASCII download and/or save your data before the menu is displayed.

3.4 Real-time clock considerations

The real-time clock DataBridge SDR uses a small lithium battery to maintain time when power is not applied. The life of this battery should exceed 5 years.

If you find DataBridge SDR is not keeping time correctly or that the time is displayed with a question mark (**?**) after it, you may need to replace the battery.

To replace the real-time clock's battery, find the battery clip located next to the DataBridge SDR DIP switches (see Figure 5.1). Pull the DataBridge SDR circuit board forward until you can extract the battery from its holder. Replace the battery with a Panasonic CR2032, or equivalent, making sure the positive (+) face is in contact with the battery clip.

4

Configuration Menu Reference

The DataBridge SDR configuration menu system is split into submenus. You can use menu functions to manage files, configure and communicate with the data port, set date and time, set up output messages, download data, configure the storage media, and control DataBridge SDR without using the front panel buttons.

4.1 Main Menu

DataBridge SDR's core functions are accessed from the main menu (see Figure 4.1).

```
Acumen Instruments Corporation            12/02/1998 14:20:30
DataBridge SDR firmware rev. 1.2b         Current filename is: BRIDGE01.DAT

 1  Set time
 2  Set date
 3  Toggle ANSI mode (ANSI is ON)
 4  Toggle messages (messages are OFF)

 5  Edit messages...
 6  SCSI drive functions...
 7  File system functions...

 8  Enter serial passthrough mode
 9  Set baud rate for attached device

 P  Enter PLAY mode
 R  Enter RECORD mode

Enter choice (1,2,3,4,5,6,7,8,9,P,R)
```

Figure 4.1. DataBridge SDR main menu

The main menu includes functions for controlling both DataBridge SDR and the attached device.

Serial passthrough mode provides a means for communicating with the device connected to the data port. To enter passthrough mode, press **8** from the main menu. To return to the main menu, type **+++**, then wait two seconds for the menu to appear.

Note: incorrect handshaking settings may cause DataBridge SDR to hang during passthrough mode. Particularly, enabling RTS/CTS handshaking for a device that doesn't support hardware handshaking may cause these hangs. If DataBridge SDR hangs during passthrough, remove power for five seconds, then reapplying power.

To set the baud rate for the data port, press **9**, then select a baud rate from the displayed list (2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400 bps). Select a baud rate that matches the rate used by the device attached to the data port. You can use Equation 4.1 to configure the data port for "nonstandard" baud rates.

$$divisor = \mathrm{int}\left(\frac{7372750}{\text{desired baud rate in bps}}\right)$$

Equation 4.1. Equation for specifying an arbitrary baud rate divisor.

Like the Play and Record buttons, the main menu commands **P** and **R** are used to immediately enter play and record modes. To return to stop mode, hold the **Ctrl** key and press **C** (**Ctrl**-**C**) or press the Stop button.

4.2 Edit Messages

To enter the Edit Messages submenu, press **5** from the main menu. The Edit Messages menu appears (see Figure 4.2).

```
Acumen Instruments Corporation
DataBridge SDR firmware rev. 1.2b

#  interval  I  CR LF message contents
0  00000000  N  N  N
1  00000000  N  N  N
2  00000000  N  N  N
3  00000000  N  N  N
4  00000000  N  N  N
5  00000000  N  N  N
6  00000000  N  N  N
7  00000000  N  N  N
8  00000000  N  N  N
9  00000000  N  N  N

 1  Edit message contents
 2  Edit message parameters
 Q  Return to main menu

Enter choice (1,2,Q)
```

Figure 4.2. The Edit Messages submenu.

The items in the Edit Messages submenu perform like menu items 3 and 4 of the menu described in the User's Manual.

From the main menu (see Figure 4.1), pressing **4** enables or disables all messages. If you are using the message feature, be sure the main menu displays "messages are ON" after menu item 4.

To return to the Main menu from the Edit Messages menu, press **Q**.

4.3 SCSI Drive Functions

To enter the SCSI Drive Functions submenu, press **6** from the Main menu. The SCSI Drive Functions menu appears (see Figure 4.3).

```
Acumen Instruments Corporation
DataBridge SDR firmware rev. 1.2b

 1  Select SCSI target ID (ID=05)
 2  Set power-on delay (delay=00000015 seconds)
 3  Set suspend parameters for Quantum hard drives (OFF)
 4  Perform REQUEST SENSE command
 5  Perform MODE SENSE command
 Q  Return to main menu

Enter choice (1,2,3,4,5,Q)
```

Figure 4.3. The SCSI Drive Functions submenu.

The items in the SCSI Drive Functions menu are used primarily for configuring DataBridge SDR with a new mass storage device or performing diagnostics on a SCSI device. The submenu also includes spinup delay parameters and functions specifically for Quantum™ hard drives.

When you install a new storage device, you must tell DataBridge SDR which SCSI ID the storage device uses. Do this by pressing **1**. DataBridge SDR prints a list of SCSI ID's and devices found (see Figure 4.4). The current SCSI target is marked with the letter "T". The initiator device (DataBridge SDR) is marked with the letter "I". Type the number (**0**-**7**) that corresponds to the mass storage device or press **Enter** to keep the current target ID setting.

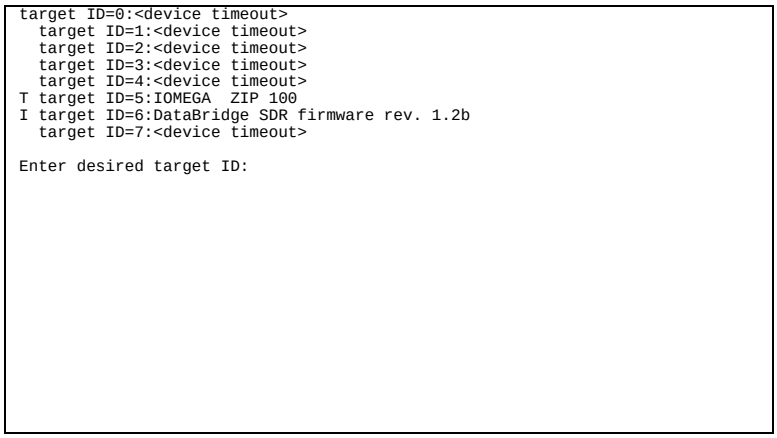


Figure 4.4. The select SCSI target ID function.

Menu item 2 controls drive spinup delays. The spinup delay is the amount of time after power is applied (in seconds) that DataBridge SDR waits before entering record mode. For instance, if the power-on delay is set to 30 seconds, DataBridge SDR will wait 30 seconds before accessing the storage device. This allows time for drives with high spindle speeds to reach maximum speed before reads and writes are attempted.

Use menu item 3 to configure hard drive power-saving features. When enabled ("ON"), this feature instructs Quantum™ hard drives to enter a power-saving mode (sleep mode) once they have been idle for a specific period of time (specified in tenths of seconds).

Menu items 4 and 5 are used by support personnel to diagnose problems with SCSI storage devices.

To return to the Main menu from the SCSI Drive Functions menu, press **Q**.

4.4 File System Functions

To enter the File System Functions submenu, press **7** from the main menu. The File System Functions submenu appears (see Figure 4.5).

```
Acumen Instruments Corporation
DataBridge SDR firmware rev. 1.2b          Current filename is: BRIDGE01.DAT

 1  Display root directory
 2  Change current filename
 3  Delete file
 4  Rename file
 5  Toggle append mode (append is ON)
 6  Download file via XMODEM
 7  Download file as ASCII text
 8  Set scheduled file close parameters (OFF)
 Q  Return to main menu

Enter choice (1,2,3,4,5,6,Q)
```

Figure 4.5. The File System Functions submenu.

Using the File System Functions menu, you can display a directory of files, delete and rename files, and download files. You can also control the filename DataBridge SDR uses for recording, the way DataBridge SDR resumes recording when power is lost and how often DataBridge SDR creates a new file for recording data.

To display the current drive's root directory, press **1**. If the root directory contains files, each file's name, attributes, last modified time/date, and file size in bytes are shown (see Figure 4.6). Once the directory has been displayed, press any key to return to the File System Functions menu.

```
Enter choice (1,2,3,4,5,6,Q) 1
BRIDGE01.DAT         a    12:07:34  12/07/1998    0000039424
BRIDGE02.DAT         a    17:03:46  09/15/1998    0000115215

Press any key to continue...
```

Figure 4.6. Displaying the root directory.

To change the filename DataBridge SDR uses to record data, press **2** from the File System Functions submenu. When you are finished, the specified file name appears at the top of the File System Functions submenu (see

Figure 4.5). In addition to file recording and playback, this filename is used in menu options 3, 4, 6, and 7.

To delete a file found in the root directory, first specify the filename to delete using menu option 2, then use menu option 3 to delete the file.

To rename a file, specify its filename using menu option 2, then press **4**. When prompted, enter a new name for the file. When using menu options 3 and 4, if the specified file is not found, DataBridge SDR simply returns to the File System Functions menu.

Menu options 6 and 7 allow you to download the current file using terminal software. To initiate an XMODEM download, press **6** and wait for the "begin your download" message (see Figure 4.7). Then, using your terminal software, start an XMODEM download. You can cancel an XMODEM download and return to the File System Functions submenu by holding the **Ctrl** key and pressing **X** (**Ctrl**-**X**).

```
Acumen Instruments Corporation
DataBridge SDR firmware rev. 1.2b          Current filename is: BRIDGE01.DAT

 1  Display root directory
 2  Change current filename
 3  Delete file
 4  Rename file
 5  Toggle append mode (append is OFF)
 6  Download file via XMODEM
 7  Download file as ASCII text
 8  Set scheduled file close parameters (00036000 seconds)
 Q  Return to main menu

Enter choice (1,2,3,4,5,6,Q) 6
Begin your XMODEM download now (use CTRL-X to cancel)
```

Figure 4.7. Downloading a file via XMODEM.

Note: DataBridge SDR uses XMODEM checksum protocol. Terminal software that automatically selects between XMODEM checksum and XMODEM CRC may require 5-15 seconds to determine that it is in XMODEM checksum mode and begin a download.

You can use menu option **7** to download a file as ASCII text. ASCII downloading doesn't provide error checking, but is useful for displaying short files or for downloading using terminal software that doesn't support XMODEM. To initiate an ASCII download, press **7**. When the "begin your download" message appears, (optionally) initiate an ASCII download using your terminal software, then press any key to begin or hold the **Ctrl** key and press **C** (**Ctrl**-**C**) to return to the File System Functions submenu.

```
Acumen Instruments Corporation
DataBridge SDR firmware rev. 1.2b          Current filename is: BRIDGE01.DAT

1  Display root directory
2  Change current filename
3  Delete file
4  Rename file
5  Toggle append mode (append is OFF)
6  Download file via XMODEM
7  Download file as ASCII text
8  Set scheduled file close parameters (00036000 seconds)
Q  Return to main menu

Enter choice 1,2,3,4,5,6,Q) 7
Press any key to begin your ASCII download (use CTRL-C to cancel)
```

Figure 4.8. Downloading a file via ASCII.

When power is lost during recording, DataBridge SDR can either append new data to the current file when power is restored or begin recording using a new file. Menu option 5 turns append mode on and off. The menu displays the state of append mode.

When append mode is off, DataBridge SDR will generate a name for the new file based on the current filename. It does this by incrementing the filename using the characters **0** through **9** and **A** through **Z**. If the file's name without extension is less than eight characters, DataBridge SDR pads the name with zeros when append mode is off. Examples of filename generation are shown in Figure 4.9.

Before Incrementing	After Incrementing
BRIDGE.DAT	BRIDGE01.DAT
BRIDGE01.DAT	BRIDGE02.DAT
BRIDGE09.DAT	BRIDGE0A.DAT
BRIDGE0Z.DAT	BRIDGE10.DAT
BRIDGE10.DAT	BRIDGE11.DAT

Figure 4.9. Generating filenames when append mode is off.

Note: A disk's root directory typically holds only 512 directory entries. To avoid exceeding this 512 file limit, do not turn append mode off in environments where power will be lost frequently.

DataBridge SDR can also periodically close and reopen files. This is useful to ensure that data is committed to the disk, especially when recording at low data rates. When used with append mode off, scheduled file closings ensure that your data files are a manageable size. Each file is stamped with the date and time when closed, which can later provide useful diagnostic information.

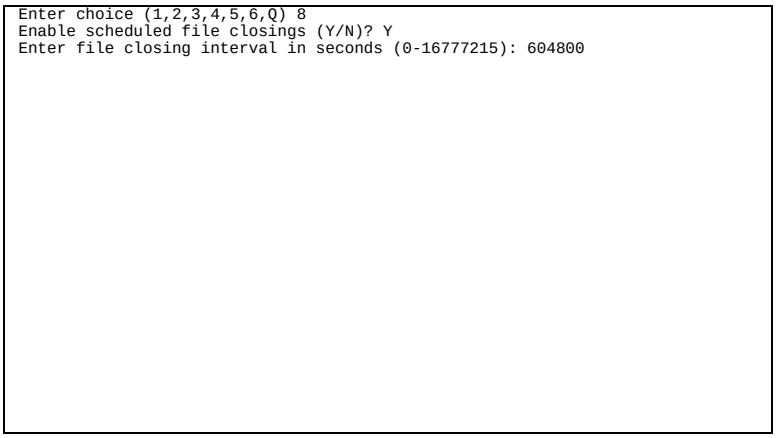


Figure 4.10. Configuring scheduled file closings.

To schedule file closings, press **8** from the File System Functions submenu. When prompted, press **Y**, then enter the file closing interval in seconds (up to 16777216 seconds). Table 4.1 provides useful conversion factors for specifying file closing intervals.

Interval	Seconds
1 second	1
1 minute	60
1 hour	3600
1 day	86400
1 week	604800
1 month*	2629800
6 months*	15778800

*based on a 365¼-day year

Table 4.1. File closing intervals.

As with other submenus, you can return to the main menu by pressing **Q**.

5 DIP Switch Reference

5.1 Overview

DIP switch settings are used to customize the way DataBridge SDR operates for your application. You can access the DIP switches by removing the DataBridge SDR front panel (see Figure 5.1). Table 5.1 summarizes each DIP switch function.

Figure 5.1. Location of the DataBridge SDR DIP switches.

5.1.1 Enabling data port handshaking (switch 1)

If your serial data source supports it, you may wish to use switch 1 to enable hardware handshaking using the RTS and CTS signal lines (see Table 5.1). This prevents lost data during long disk seeks.

5.1.2 Enabling configuration port handshaking (switch 2)

You may also want to enable hardware handshaking for the configuration port using switch 2 if you plan to download data using the serial port or if you are using a slow computer and notice lost characters in the DataBridge menus (see Table 5.1).

5.1.3 Reserved switches (switches 3 and 4)

Switches 3 and 4 are reserved and must be set to the off position (see Table 5.1).

5.1.4 Displaying and hiding menus (switch 5)

If you connect to the configuration port using a radio modem or other serial link with a low data rate, you may wish use switch 5 (see Table 5.1) to hide the configuration menus to make DataBridge SDR more responsive. When menus are hidden, keystrokes still active menu functions.

5.1.5 Disabling buttons (switch 6)

You can use switch 6 to disable the DataBridge SDR front panel buttons (see Table 5.1). Use this option if you control DataBridge SDR using only the configuration port. This prevents accidental contact or switch failure from returning DataBridge SDR to Stop mode. This option may be useful when DataBridge SDR will operate for unattended for long periods of time.

5.1.6 Disabling indicators (switch 7)

When power saving is important, you can use switch 7 to disable the front panel indicators as shown in Table 5.1. When the front panel indicators are disabled, you can still communicate via the configuration port to determine DataBridge SDR's current mode.

5.1.7 Disabling resume mode (switch 8)

If you are troubleshooting a problem with DataBridge SDR and have resume mode turned on (see Section 4.4), you may need to use switch 8 to force DataBridge SDR into Stop mode when you apply power. Once you've gotten DataBridge SDR stopped, you can enable resume mode again using switch 8 as shown in Table 5.1.

5.1.8 Initiator ID (switch 9)

DataBridge SDR is a SCSI initiator whose ID is, by default, set to 6. If you are using a device that occupies SCSI ID 6, you may need to use switch 9 to change the SCSI ID to 7 as shown in Table 5.1.

5.1.9 Setting configuration port baud rate (switches 10-12)

In some cases, you may wish to choose higher (or lower) data rates for the configuration port. For example, you may need a lower speed if you wish to configure, control, and monitor DataBridge SDR remotely using a radio modem. You may need a higher speed if you intend to download data through the serial port using XMODEM. Switches 10, 11, and 12 are used to select a baud rate for the configuration port (see Table 5.1).

switch	setting			function	
1	**off** on			**disable hardware handshaking for the data port** enable hardware handshaking for the data port	(default)
2	**off** on			**disable hardware handshaking for the config. port** enable hardware handshaking for the configuration port	(default)
3	**off** on			reserved (switch must be off)	
4	**off** on			reserved (switch must be off)	
5	**off** on			**display menus** hide menus	(default)
6	**off** on			**enable the Stop, Play, and Record buttons** disable user interface buttons	(default)
7	**off** on			**enable indicators (LEDs)** disable indicators	(default)
8	**off** on			**enable resume mode** force DataBridge SDR into Stop mode on power-up	(default)
9	**off** on			**initiator SCSI ID=6** initiator SCSI ID=7	(default)
10:11:12				**configuration port data rate**	
	off	off	off	230,400 bps	
	off	off	on	115,200 bps	
	off	on	off	57,600 bps	
	off	on	on	38,400 bps	
	on	off	off	19,200 bps	
	on	**off**	**on**	**9600 bps**	(default)
	on	on	off	4800 bps	
	on	on	on	2400 bps	

Table 5.1. DIP switch settings

6

Troubleshooting

6.1 Frequently Asked Questions (FAQ)

Q: When I press the Record or Play button while in Stop Mode, the indicators don't seem to respond quickly. What's wrong?

A: The Record and Play indicators only glow once data recording or playback has begun. Slow media, disk fragmentation, or opening a large existing file all require more preparation time before recording or playback can begin.

As a rule, wait until the Record or Play indicator glows before transmitting data or expecting to observe serial output. If the Record or Play indicator doesn't glow after ten seconds, the disk may be full or may be experiencing a hardware problem. Reset DataBridge SDR by removing and reapplying power to see if it successfully enters Record or Play mode. If not, check the disk for available space or media errors using a computer.

Q: Why does the Record indicator blink when DataBridge SDR is in Record mode?

A: DataBridge SDR shuts off the record indicator momentarily while it allocates disk clusters and updates directory entries. This "blinking" is normal behavior intended to be used as a diagnostic tool and gauge of disk performance and data volume.

Q: When I press the Record button, DataBridge SDR ejects my Zip disk. Why?

A: DataBridge SDR ejects removable media and returns to Stop Mode when it can no longer allocate clusters. Delete files from the Zip disk, reformat it, or replace it. Sometimes disks with corrupt files cause disks to appear full prematurely. Use ScanDisk, included with DOS or Windows 95™ to check your disk for allocation errors.

Q: I've been using DataBridge SDR with a hard disk for about six months. Why does it now stay in Stop Mode when I press the Record button?

A: As with the Zip disk, DataBridge SDR returns to Stop Mode when it can no longer allocate disk clusters (DataBridge SDR obviously cannot eject a hard disk).

Q: I checked my disk and it is only 99% full. However, DataBridge SDR still ejects it when I press the record button. Why?

A: To maximize data integrity, DataBridge SDR allocates clusters in advance. DataBridge SDR will enter Record mode only when it is able to allocate these clusters. DataBridge SDR is designed to allocate only about 99% of the drives free space, leaving the last sector of the file allocation table (FAT) free.

Q: Why does the date/time display in menu mode have a question mark after it?

A: The date and time are shown with a question mark whenever the real-time clock's internal oscillator stops. This may occur when the battery voltage is low or the battery is temporarily shorted or removed. If this happens repeatedly, replace the real-time clock's battery.

Q: I want to use my own 5 VDC power supply with DataBridge SDR. How do I connect it?

A: The power receptacle on the rear panel of DataBridge SDR is a Series 1 size 11 four-pin standard-sex AMP Circular Plastic Connector (CPC), AMP part number 206061-1. The plug that connects to DataBridge SDR's power receptacle is AMP part number 206060-1.

The connector's pinout is shown in Table 6.1.

pin	function
1	+5.0 VDC
2	ground
3	ground
4	+12.0 VDC (if needed)

Table 6.1. Power connector pinout.

Pay careful attention to DataBridge SDR's electrical specifications and power requirements (see Appendix B).

Q: When I connect DataBridge SDR to my computer, why do I see garbage on my screen?

A: Your terminal's baud rate and DataBridge SDR's baud rate do not match. Unrecognizable characters may also be a symptom of mismatched data formats (data bits, stop bits, parity).

Q: I changed my serial parameters in HyperTerminal and I still see garbage. Why?

A: HyperTerminal requires that you "disconnect" and "reconnect" (from the Call menu) before its serial parameters actually change.

Q: Why does HyperTerminal lock up/run very slowly when I connect it to DataBridge SDR?

A: HyperTerminal does this when it expects handshaking signals and doesn't get them. If you are patient, you can wait for HyperTerminal to display its Call menu and choose "disconnect" (then disable hardware handshaking) or you can enable DataBridge SDR's hardware handshaking on the jumper block.

Q: I have a question that is not in this FAQ. How can I find an answer?

A: Call us, write us, or e-mail us. Your question may be one others have and are afraid to ask. See Section 7.1 of the User's Manual for contact information.

7

Service and Support

7.1 Contacting Acumen Instruments Corporation

7.1.1 Technical support

Service and technical support can be reached between the hours of 9AM and 5PM (Central Standard Time) Monday through Friday. Acumen Instruments Corporation can be reached at the following phone numbers:

(515) 233-6560 (voice)
(515) 233-0078 (fax)

7.1.2 Mail

Acumen Instruments Corporation can be reached by mail at:

Acumen Instruments Corporation
209 S. Fifth Street #2
Ames, IA 50010-6848
USA

7.1.3 E-mail

Acumen Instruments Corporation can be reached via e-mail at:

info@acumeninstruments.com

7.1.4 World Wide Web

Acumen Instruments Corporation maintains a web site which contains product information and downloads:

http://www.acumeninstruments.com

7.2 Returning Equipment

Before returning equipment to Acumen Instruments Corporation, please call for an RMA number and shipping information. This allows us to plan for your shipment in order to provide the best possible service. When returning equipment, please include a note indicating the symptoms of the failure and any other pertinent information.

7.3 Warranty

7.3.1 One year warranty

Acumen Instruments Corporation warrants this product to be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. During the warranty period, Acumen Instruments Corporation will, at its option, either repair or replace products that prove to be defective.

7.3.2 Exclusions

This warranty shall not apply to any defect, failure or damage caused by misuse, abuse, improper application, alteration, accident, disaster, negligence, use outside of the environmental specifications, improper or inadequate maintenance, or incorrect repair or servicing not performed or authorized by Acumen Instruments Corporation.

7.3.3 Limitations

ACUMEN INSTRUMENTS CORPORATION SHALL IN NO EVENT HAVE OBLIGTIONS OR LIABILITIES TO BUYER OR ANY OTHER PERSON FOR LOSS OF PROFITS, LOSS OF USE OR INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY, OR ANY OTHER THEORY OR FORM OF ACTION, EVEN IF ACUMEN INSTRUMENTS CORPORATION HAS BEEN ADVISED OF THE POSSIBILITY THEREOF, ARISING OUT OF OR IN CONNECTION WITH THE SALE, DELIVERY, USE, REPAIR, OR PERFORMANCE OF THIS PRODUCT (INCLUDING EQUIPMENT, DOCUMENTATION AND SOFTWARE). IN NO EVENT SHALL THE LIABILITY OF ACUMEN INSTRUMENTS CORPORATION ARISING IN CONNECTION WITH ANY PRODUCT EXCEED THE ACTUAL AMOUNT PAID FOR SUCH A PRODUCT.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, WRITTEN OR ORAL, EXPRESSED OR IMPLIED, INCLUDING IMPLIED WARRANTIES OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

A

DataBridge SDR Evaluation Kit

A.1 Overview

The evaluation kit is intended for use by those familiarizing themselves with DataBridge technology for custom applications. Housed in an attractive desktop enclosure, the evaluation system is also suitable for use in laboratory and other protected environments.

Figure A.1. DataBridge SDR evaluation kit (shown equipped with an Iomega Zip™ drive).

The evaluation kit includes an integral 120/240 VAC power supply, mass storage device, and necessary cabling. Because it contains the DataBridge OEM circuit board, the evaluation kit is functionally identical to DataBridge SDR.

A.2 Front panel

Like the rugged DataBridge SDR, the evaluation kit is controlled using its illuminated stop, play, and record buttons. The data indicator and power indicator are also found on the front panel. The evaluation kit is typically configured with removable mass storage, which is accessible from the front panel.

Figure A.2. Front panel of the DataBridge SDR evaluation kit (shown equipped with an Iomega Zip™ drive).

A.2.1 Accessing DIP switches and RTC battery

The configuration DIP switches (see Figure 5.1) and real-time clock battery are found on the DataBridge OEM circuit board, directly behind the front panel.

To access the DIP switches or battery, first remove the four screws found in the rubber feet on the base of the unit and remove the housing by sliding it toward the rear. Then, carefully detach the plastic front panel from the steel frame.

Refer to Table 5.1 for DIP switch functions.

A.3 Rear panel

On the rear panel of the DataBridge SDR evaluation kit are the 120/240 VAC power cord connector and power switch, the DB9 serial port connectors, and the Centronics-50 SCSI connector. The SCSI ID selector is not used.

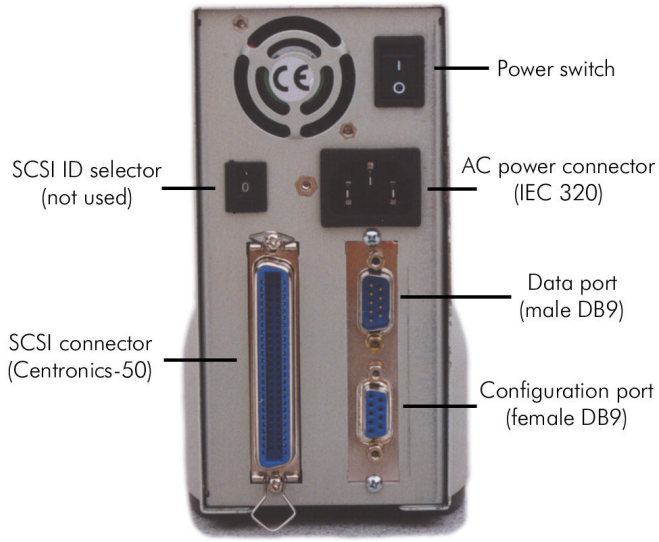


Figure A.3. Rear panel of the DataBridge SDR evaluation kit.

B

Serial Port Basics

B.1 Serial specifications

Serial data is any data that is sent one bit at a time using a single electrical signal. In contrast, *parallel data* is sent 8, 16, 32, or even 64 bits at a time using a signal line for each bit. Data that is sent without the use of a master clock is said to be *asynchronous serial* data.

Several communications standards exist for the transfer of asynchronous serial data. Common PC's transfer data using the EIA RS-232C (also known as V.28 or V.24). Updated versions of this standard include RS-232D and EIA/TIA-232E, but most literature still refers to the RS-232C or RS-232 standard.

Other asynchronous serial standards in common use include RS-422, RS-423, and RS-485. These standards allow higher data rates and longer cable lengths than RS-232 and are common in industrial settings.

B.2 Data rates

The *baud rate* for a serial connection is the number of bits that are transmitted per second. It is specified in bits/second or baud. For example, a 9600 baud serial link transfers 9600 bits per second.

The EIA RS-232C standard permits data rates up to 19200 bps and cable lengths up to 400 meters (but not both).

data rate (bps)	maximum distance (meters)	(feet)
19200	15	45
9600	25	76
4800	50	152
2400	100	304
1200	200	608
600	400	1216

Table B.1. Data rates and distances for RS-232 communications.

Although the specification only defines rates up to 19200 bps, communication using data rates as high as 230400 bps and a short (< 2 meter) cable is common. Standard modems communicate with computers at up to 115200 bps.

As you may have guessed, the use of high baud rates requires more capable computer hardware. At high baud rates, a computer must process as many as 23000 characters per second. The constant attention a computer must pay to its serial port makes this problematic particularly in multitasking environments such as Microsoft Windows 3.1/95/98/NT.

B.2.1 Data rates and the UART

Computer hardware designers solve this problem by allowing the computer to respond to characters less frequently. A Universal Asynchronous Receiver/Transmitter (UART), the component responsible for communicating via RS-232, may contain several bytes of memory called a FIFO (first-in, first-out memory).

The original IBM PC (and many of its successors) used the 8250 UART, which contained no FIFO. That is, a computer with 8250 (or 16450) UART's must respond to every incoming character.

Newer PC's incorporate the 16550 UART or a variant. The 16550 incorporates a 16-byte FIFO and is **mandatory** for communications at speeds above 9600 bps and is important for error-free communications at lower speeds as well.

You can find out which type of UART's your computer uses by using the MSD.EXE tool provided with DOS and Windows or by looking in the Windows 95/98 control panel.

B.3 More asynchronous serial parameters

In most cases, the data rate in bytes/second can be approximated by dividing the baud rate (in bits/second) by 10. If a byte consists of 8 bits, why divide by 10?

To transfer data asynchronously, the UART must *frame* the 8 data bits between a stop bit and a start bit. The start bit is always a zero, while the stop bit is always a one. So, a byte of data sent serially is made up of 10 bits instead of the usual 8.

Asynchronous serial devices can communicate using 7 or 8 data bits, and 1, 1½, or 2 stop bits. To further complicate matters, devices can also employ a *parity* bit instead of an eighth data bit to check for errors. Even parity systems transmit a one when the sum of the seven bits is an even number, while odd parity systems transmit a one when the sum is odd. Still more exotic systems may specify "mark" or "space" parity, where the parity bit is always a one or zero, respectively.

What does all of this mean? Device vendors usually specify their data rate and format using statements like "9600, 8N1", which translates to 9600 bps, 8 data bits, no parity, and 1 stop bit or "19200, 7E1", which translates to 19200 bps, 7 data bits, even parity, and 1 stop bit.

Most serial devices format of eight data bits, no parity, and one stop bit (8N1).

B.3.1 DTE and DCE

The RS-232 specification defines two classes of devices: data terminal equipment (DTE) and data communication equipment (DCE). Your computer's serial port is configured for DTE operation, since the computer acts as a terminal. Modems and many other serial devices are configured as DCE, since they are communications equipment.

What's the difference? A DTE device's TD signal means "I transmit data on this line." A DCE's TD signal can be read "You (the DTE) transmit data to me on this line." A DTE's RD signal means "I receive data on this signal line." A DCE's RD line means, "You, the DTE, will receive the data I transmit on this signal line." Sound confusing?

A look at a the DB9 connector pinouts and signal direction with respect to DTE (e.g. your computer) makes things a little more clear.

signal name		pin number 25-pin	9-pin	direction
transmitted data	**TD**	2	3	DTE? DCE
received data	**RD**	3	2	DTE? DCE
request to send	**RTS**	4	7	DTE? DCE
clear to send	**CTS**	5	8	DTE? DCE
data terminal ready	**DTR**	20	4	DTE? DCE
data set ready	**DSR**	6	6	DTE? DCE
data carrier detect	**DCD**	8	1	DTE? DCE
ring indicator	**RI**	22	9	DTE? DCE
signal ground	**GND**	7	5	

Table B.2. Pinouts for 9-pin and 25-pin serial connectors.

The cable that connects DTE devices (such as your computer) and DCE devices (such as your modem) is simple. It simply connects TD pin to TD, pin RD to RD, etc. A cable that connects DTE to DTE or DCE to DCE must connect the TD to RD and RD to TD. This cable is referred to as a *null modem* cable because it can connect two terminals (DTE's) without the use of modems (DCE's). Note that GND pins are always connected.

Most devices have female connectors (DB9 or DB25) if they are configured for DCE operation and male connectors if they are configured for DTE operation, but this is not always the case.

There is a simple trick for determining whether a device is DTE or DCE. Connect a voltmeter's ground line to the connector's GND pin. Then, probe the voltage on the TD and RD pins. If the TD pin voltage is small ($-3V < Vin < +3V$), the device is configured to receive data on the TD pin, and thus is a DCE device. Likewise, if the RD pin voltage is small, the device is receiving data on the RD pin, and thus is DTE.

B.3.2 Handshaking

Handshaking signals by the receiving device to tell the transmitter "I am ready for data" or "I am not ready for data." These signals are optional: the receiver may always be ready for data or may choose to simply discard data it couldn't process.

A DTE device asserts the "request to send" (RTS) signal when it is ready to receive data and deasserts it when it cannot accept data. Likewise, a DCE device asserts "clear to send" (CTS) when it is ready to receive data. The RTS and CTS signals form a *handshaking pair*, and their use constitutes *RTS/CTS handshaking*.

The "data terminal ready" (DTR) signal, asserted by the DTE, and the "data set ready" (DSR), asserted by the DCE serve similar functions and constitute *DTR/DSR handshaking*. A DTE or DCE devices may employ either or both forms of handshaking. Often, deasserting RTS or CTS signals "micro" events, such as a full buffer that is full but will be empty soon, while

deasserting DTR or DSR may signal "major" events such as that power has not been applied.

RTS/CTS handshaking and DTR/DSR handshaking are both referred to as *hardware handshaking*. Another form of handshaking, XON/XOFF or *software handshaking*, requires that the receiver send a character (Control-S, ASCII 19) to halt data transfer and another character (Control-Q, ASCII 17) to resume transfer. Although this method eliminates the need for the RTS, CTS, DTR, or DSR signals, it suffers from slow response time by the receiver and renders 2 characters of the 256-character ASCII set unusable.

At data transfer rates above 9600 bps, it is important to employ handshaking wherever possible even when UARTs with FIFO buffers are used. Remember that at 115200 bps, a 16-byte FIFO fills in only 1.3 milliseconds, while many mass storage devices advertise average seek times of 20-30 milliseconds.

B.3.3 Voltage levels

For noise immunity and long cable lengths, RS-232 devices convert TTL/CMOS-level signals (0V = logic zero, +5V or +3.3V = logic one) to higher voltage bipolar signals. For the TD and RD signal lines, RS-232 devices use a voltage between –3V and –25V to transmit a one and a voltage between +3V and +25V to transmit a zero. For the other signal lines (RTS, CTS, etc.), RS-232 devices use +3V to +25V to assert the signal and –3V to –25V to deassert the signal. These voltage levels are defined in the EIA/TIA-232E specification. So, when a DTE devices drives RTS at –9.50V, it is signaling the DCE to stop sending data.

A few devices, particularly devices that communicate at low data rates or over short cables, bypass the voltage conversion altogether. These devices often require "computer interface kits" that are really no more than a level converter in a box. These serial ports are often referred to as TTL RS-232, CMOS RS-232, or 5 Volt RS-232 ports and require level converters to interact with computers and other serial devices.

C

DataBridge SDR Electrical Specifications

C.1 Power requirements

DataBridge SDR itself requires only a regulated +5VDC power source. Additional power requirements depend on the installed recording media. A typical hard disk requires 5-15W during operation (after spinup). Some disks require 5VDC while others require both +5VDC and +12VDC power. Solid-state disks require 2W (112 MB model) at +5VDC, which keeps power requirements for the entire system to a single +5VDC supply. The Iomega Zip™ drive requires only +5VDC. Table C.1 outlines power consumption with an Iomega Zip™ drive installed.

DataBridge SDR circuit board	+5VDC	60mA
DataBridge SDR with Iomega Zip™ Drive		
Stop mode	+5VDC	550mA avg. 1200mA peak
Play mode	+5VDC	800mA avg. 1200mA peak
Record mode	+5VDC	800mA avg. 1200mA peak

Table C.1. DataBridge SDR power consumption with Iomega Zip™ drive installed.

DataBridge SDR is also available with an optional 120/220VAC power supply. Its power requirements are as listed in Table C.2.

120/220 VAC External Power Supply	
input voltage	100-250 VAC
input frequency	50-60 Hz
input current	1.2 A

Table C.2. Power requirements for optional AC power supply.

C.1.1 Power receptacle pin configuration

pin	**function**
1	+5.0 VDC
2	ground
3	ground
4	+12.0 VDC (if needed)

Table C.3. The DataBridge SDR power receptacle pin configuration.

C.2 Serial communications

serial port	
electrical interface compliance	EIA/TIA-232E and V.28
data rates	300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400 bps
stop bits	1 or 2
parity	none, even, odd
handshaking	RTS/CTS, DTR/DSR

Table C.4. Serial communications specifications for DataBridge SDR.

C.3 SCSI interface

SCSI interface	
SCSI compliance	ANSI SCSI standard X3.131-1994
electrical interface	single-ended SCSI
SCSI transfer mode	8-bit asynchronous
SCSI commands	industry-standard SCSI command set
storage capacity	limited only by storage device and FAT file system

Table C.5. SCSI interface specifications for DataBridge SDR.

D

DataBridge SDR Mechanical Specifications

D.1 Dimensions

DataBridge SDR circuit board	
dimensions	4.00" L × 3.00" W × 0.40" H (10.2 cm × 7.6 cm × 1.0 cm)
weight	approx. 1.0 oz. (28.3 grams)
DataBridge SDR in extruded aluminum enclosure	
dimensions	11.50"D × 7.75" W × 4.20" H (29.2 cm × 19.7 cm × 10.7 cm)
weight (with Iomega Zip™ drive installed)	7lbs. 1oz. (3.2 kg)

Table D.1. DataBridge SDR dimensions.

DataBridge SDR is also available with an optional 120/220VAC power supply. Its dimensions are as listed in Table D.2.

120/220 VAC External Power Supply	
dimensions	6.00" L × 3.25" W × 2.00" H (15.25 cm × 8.25 cm × 5.08 cm)
output cord length	approx. 72" (183 cm)

Table D.2. Dimensions for optional AC power supply.

D.2 Environment

DataBridge SDR ŝ extruded aluminum enclosure, buttons and connectors are designed to, at a minimum, meet the IEC 144/855420 I.P. 65 rating (dust tight and protected against water jets) and the equivalent NEMA 12 rating (industrial use, dust tight and drip tight).

DataBridge SDR in extruded aluminum enclosure	
operating ambient temperature	0-50°C
relative humidity	up to 100% R.H., condensing
altitude	100,000 ft (limited by recording media only)

Table D.3. DataBridge SDR environment specifications.

Note: The optional external 120/220VAC power supply is not rated for use in an unprotected environment. For harsh environments an appropriate power supply should be used.

D.2.1 Desiccant

When used with removable recording media, the interior of the DataBridge SDR enclosure may be exposed to humidity when the front panel is removed to access the media. To avoid condensation inside the enclosure, the use of desiccants is recommended in humid environments.

A desiccant ŝ effectiveness will vary depending on the number of times the front panel is removed and the relative humidity in the when the front panel is removed. Monitor the humidity inside the enclosure with a disposable humidity indicator and change desiccant as needed.

A wide range of desiccant products are available from:

United Desiccants
101 Christine Drive
Rio Grande Industrial Park
Belen, NM 87002
(800) 989-DESI
(505) 864-6691
(505) 864-9296 FAX

Humidity indicators are available from:

Humidial Corporation
926 So. 8th Street
PO Box 610
Colton, CA 92324-0610
(909) 825-1793
(800) 966-1793
(909) 825-6271 FAX

E

The Switch Closure Interface

E.1 Description

The Switch Closure Interface (SwCI) is designed to provide an electrically isolated and buffered interface to the DataBridge SDR. A DataBridge SDR equipped with the SwCI will timestamp and log switch openings and closings.

The SwCI can monitor up to sixteen switch inputs (organized as two 8-switch ports). DataBridge SDR, when equipped with an SwCI, has two additional AMP CPC 13-9 receptacles on the rear panel— one for each 8-switch port (see Figure E.4).

E.2 Operation

To use the Switch Closure Interface, first connect the AMP CPC-to-screw terminal cables to the appropriate ports on the rear panel of your DataBridge SDR (see Figure E.4). Then, attach normally-open (NO) or normally-closed (NC) switches to the screw terminals. Once switches are connected to the SwCI, you can verify normal operation of the SwCI.

Figure E.4. The DataBridge SDR rear panel with SwCI installed.

With DataBridge SDR ŝ front panel removed, sixteen indicators on the front of the SwCI are exposed (see Figure E.5). If DataBridge SDR and the Switch Closure Interface are operating properly, any closed switch will light the corresponding indicator while DataBridge SDR is in Record mode. If possible, verify the operation of all switches connected to the SwCI by observing the indicators without the front panel.

Figure E.5. Sixteen indicator LED's for the SwCI.

With DataBridge SDR ŝ front panel in place and DataBridge SDR in Record mode, you can test the SwCI by generating switch events (i.e. by changing the state of any switch connected to the SwCI) and observing the data indicator on DataBridge SDR ŝ front panel. If DataBridge SDR and the SwCI are working properly, the data indicator (see Figure 1.1) should light as switches are opened or closed. Section 3.2.1 explains the function of the data indicator.

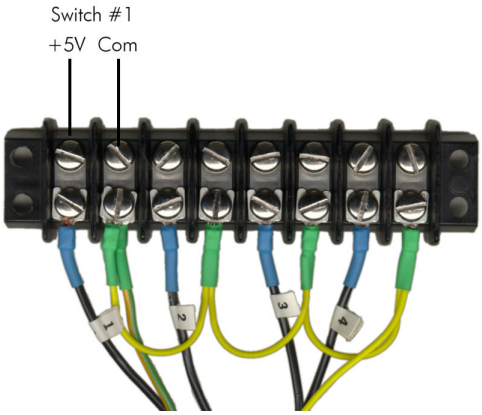


Figure E.6. Connection of switches to the screw terminals.

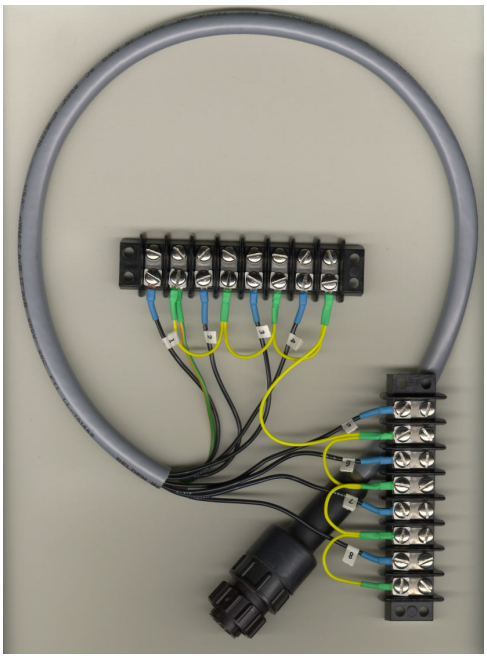


Figure E.7. Amp CPC-to-screw terminal cable. One of two used for connecting to the Switch Closure Interface (SwCI).

E.3 Switch Closure Interface Data Format

The Switch Closure Interface generates a line of telemetry on any switch transition, either open-to-closed or closed-to-open. Parsing data for only a single switch or single transition type (open or closed) is easily accomplished using a "grep" utility or the DOS "FIND" command.

The SwCI telemetry follows the format:
SW,EVENT,MM/DD/YY,HH:MM:SS,COUNTER

Table E.1 describes each of the telemetry's comma-delimited fields.

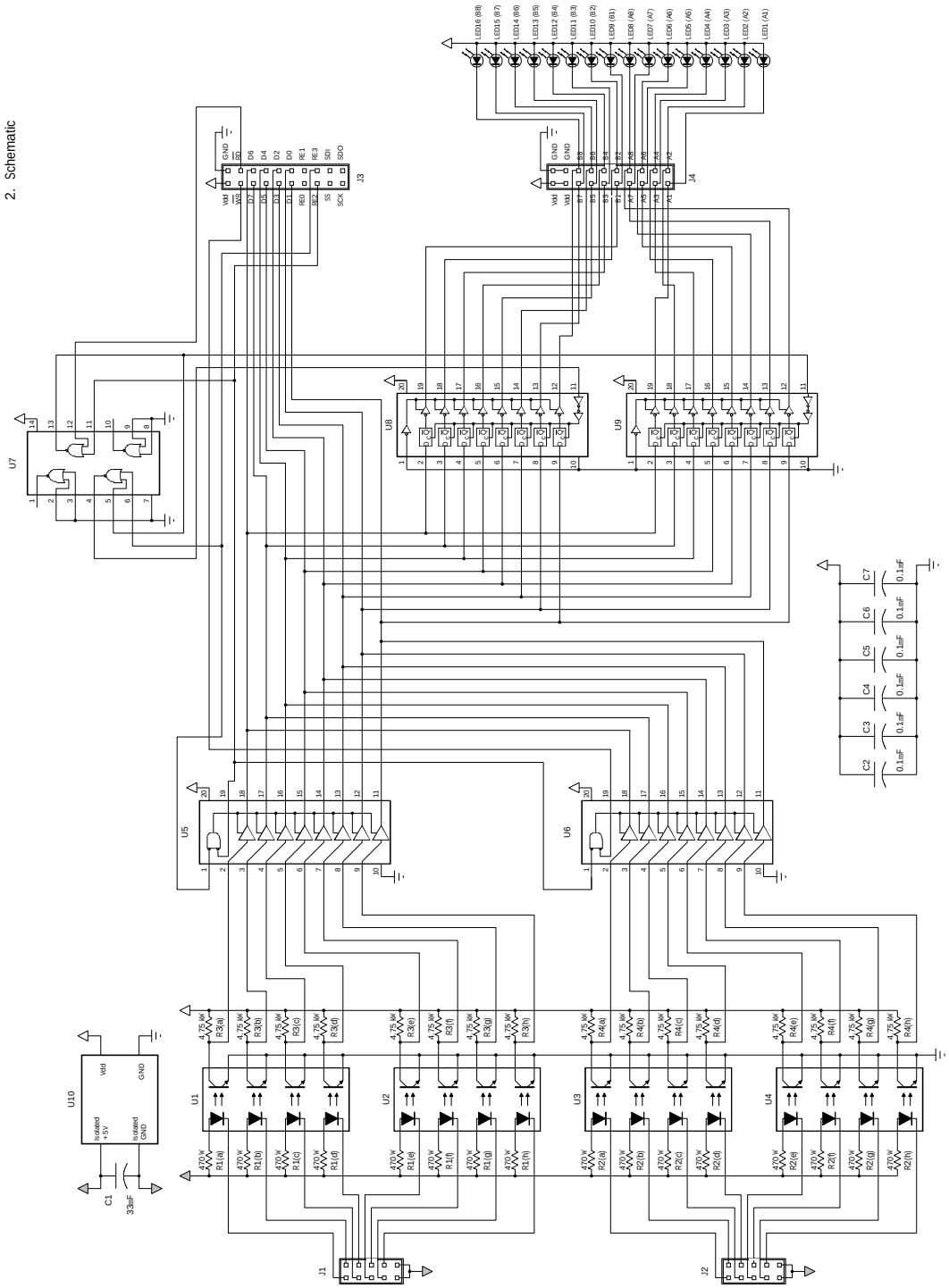
switch #	Switch that generated the event. There are two sets of eight inputs A1-A8 and B1-B8.
event type	Indicates whether the switch opened or closed. Both types of events are recorded, so the SwCI is suitable for use with both normally-open or normally-closed switches.
date	The date of the event. Rolls from "99" to "00" to for the year 2000.
time	The time of the event. Recorded in 24-hour format.
event counter	Sequential counter. This number is incremented for each event and helps determine if any data is lost or out of sequence.

Table E.1. Fields in an SwCI telemetry string.

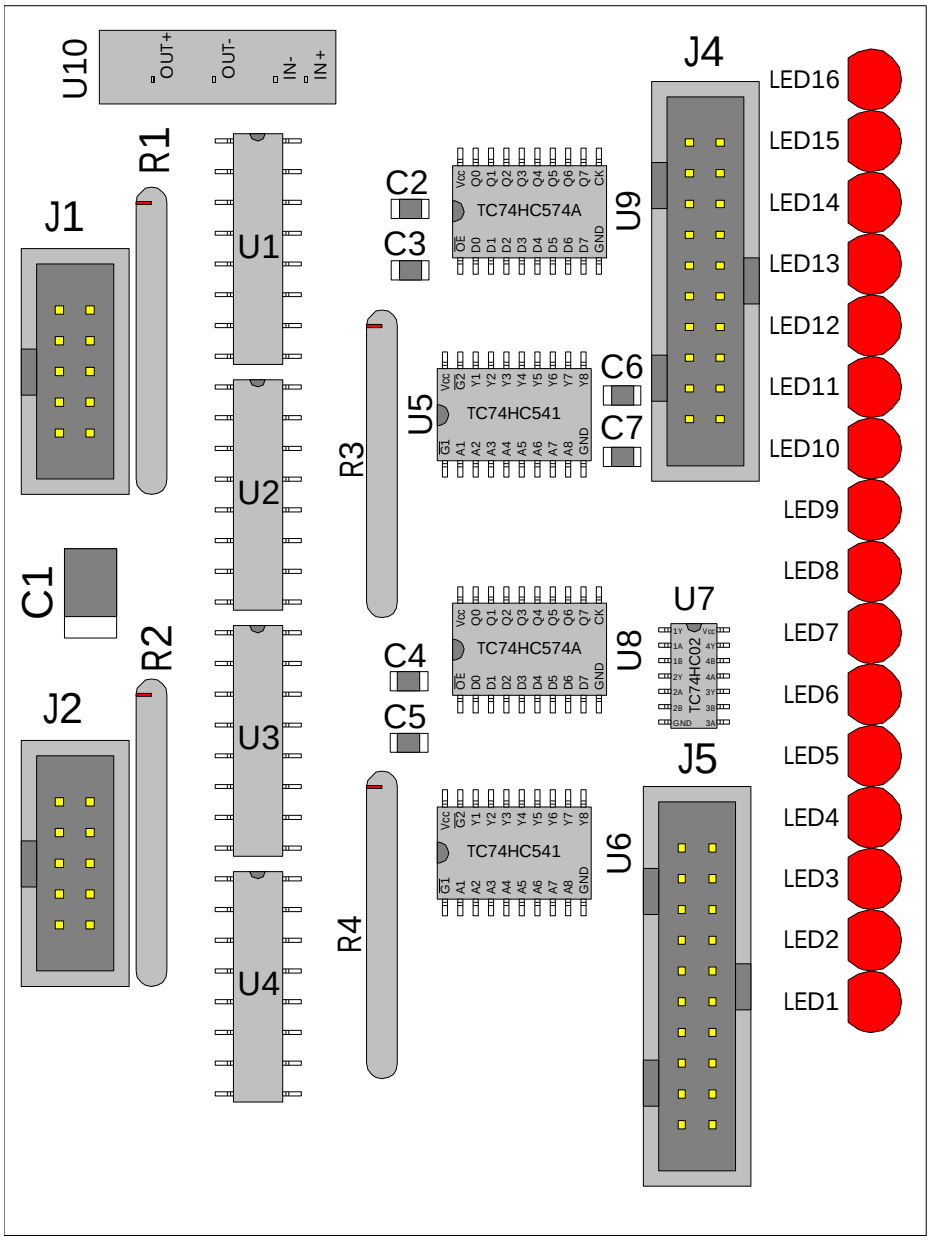
```
A1,close,05/01/98,09:10:39,00000001
A1,open, 05/01/98,09:10:45,00000002
B3,close,05/01/98,17:21:17,00000003
B3,open, 05/01/98,17:21:56,00000004
```

Figure E.8. Sample SwCI telemetry strings.

E.4 Schematic



E.5 PCB Component Locations



E.6 Bill of Materials

E.6.1 Switch Closure Interface: Circuit Board

QTY	DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER PART NUMBER	VENDOR	VENDOR PART NUMBER
1	C1	33µF/16V tantalum chip capacitor, TE Series	Panasonic	ECS-T1CD336R	Digi-Key	PCS3336CT-ND
6	C2-C7	0.1µF/50V ceramic chip capacitor, 1206 SMD	Panasonic	ECU-V1H104KBW	Digi-Key	PCC104BCT-ND
2	J1, J2	0.100" shrouded header, gold, 10-position, straight	3M	2510-6002UB	Digi-Key	MHB10K-ND
2	J3, J4	0.100" shrouded header, gold, 20-position, straight	3M	2520-6002UB	Digi-Key	MHB20K-ND
16	LED1-LED16	5V, T1-3/4, red diffused LED	QT Optoelectronics	MR3050	Digi-Key	MR3050QT-ND
2	R1, R2	Bussed, 10-pin, 9-resistor, 470O, ±2%, CSC Series	Vishay-Dale	CSC10A-01-471G	Newark	81F4857R470.0
2	R3, R4	Bussed, 10-pin, 9-resistor, 4.7kO, ±2%, thick-film conformal SIP	Bourns	4610X-101-472	Digi-Key	4610X-1-472-ND
4	U1-U4	Optocoupler, 4-channel, SMD, transistor output	NEC	PS2701-4	Digi-Key	PS2701-4NEC-ND
2	U5, U6	Octal Bus Buffer, 20-pin wide SOIC	Toshiba	TC74VHC541FW	Digi-Key	TC74VHC541FW-ND
2	U7	Quad 2-input NOR gate, 14-pin narrow SOIC	Toshiba	TC74VHC02FN	Digi-Key	TC74VHC02FN-ND
2	U8, U9	Octal D Flip-Flop, 20-pin wide SOIC	Toshiba	TC74VHC574FW	Digi-Key	TC74VHC574FW-ND
1	U10	Isolated DC-DC converter, 1W, 5V/5V single output	Power One	DSP1N5S5	Digi-Key	DSP1N5S5-ND

E.6.2 Switch Closure Interface: Internal Cable Assemblies

QTY	DESCRIPTION	MANUFACTURER	MANUFACTURER PART NUMBER	VENDOR	VENDOR PART NUMBER
2	0.100" 10-pin gold socket connector w/key, w/strain relief	CW Industries	CWR-217-10-0000	Digi-Key	CKR10G-ND
2	12"-10 conductor ribbon cable, 28AWG, stranded 7x36, 0.050" pitch, gray PVC	Belden	9L28010	Newark	36F652WA
2	Amp CPC Series 1, size13-9 receptacle, sq. flanged, sealed, std. sex	Amp	206705-3	Digi-Key	A1669-ND
9	Amp CPC Series 1 pins, gold, 24-20 AWG, crimp	Amp	66400-4	Digi-Key	A1648-ND
2	Amp CPC size 13 connector cap, circular seal, w/chain	Amp	213485-1	Digi-Key	A16043-ND
4	4-40x0.375" stainless steel socket head cap screw	Brikksen		Hokel	SSSHCS004003
4	4-40 stainless steel machine screw nut	Brikksen		Hokel	SSHN004
4	#4 stainless steel medium lock washer	Brikksen		Hokel	SSLW004

E.6.3 Switch Closure Interface: External Cable Assemblies

QTY	DESCRIPTION	MANUFACTURER	MANUFACTURER PART NUMBER	VENDOR	VENDOR PART NUMBER
2	Amp CPC Series 1, size13-9 plug, std. sex	Amp	206708-1	Digi-Key	A1302-ND
2	Amp CPC size 13 connector boot, adhesive lined heat shrink	Amp	54123-1	Digi-Key	A16047-ND
9	Amp CPC Series 1 sockets, gold, 24-20 AWG, crimp	Amp	66399-4	Digi-Key	A1661-ND
2	3'-Belden Infinity-FCC (1 million+ Flex Cycles), 9x20 AWG (7x30)	Belden	7405A	Newark	16F9504
16	0.125"x1" heat shrinkable tubing, blue	3M	FP-301	Digi-Key	FP018B-5-ND
18	0.125"x1" heat shrinkable tubing, green	3M	FP-301	Digi-Key	FP018G-5-ND
34	#6 terminal spade, 22-16AWG, short, uninsulated	Amp	36195	Digi-Key	A09001-ND
4	8-contact, 0.438" barrier block	Cinch	8-141	Digi-Key	CBB208-ND

E.7 Specifications

E.7.1 Power Requirements

The Switch Closure Interface receives its power through the internal cable connecting the SwCI to the main DataBridge circuit board. The power consumed by the SwCI will vary depending on how many switches are closed, since the optocoupler will draw about 10mA per closed switch, and if DataBridge SDR is in Record mode, since the indicator LED ŝ consume about 13mA each.

DataBridge SDR circuit board and SwCI	+5VDC	approx. 100mA
DataBridge SDR and SwCI with Iomega Zip™ Drive (no switches closed)		
Stop mode	+5VDC	600mA avg. 1250mA peak
Play mode	+5VDC	850mA avg. 1250mA peak
Record mode	+5VDC	850mA avg. 1250mA peak
DataBridge SDR and SwCI with Iomega Zip™ Drive (all switches closed)		
Stop mode	+5VDC	760mA avg. 1410mA peak
Play mode	+5VDC	1200mA avg. 1450mA peak
Record mode	+5VDC	1200mA avg. 1450mA peak

Table E.2. DataBridge SDR power consumption with SwCI and Iomega Zip™ drive installed.

E.7.2 Isolation

The Switch Closure Interface is designed to provide electrical isolation between it s circuitry and the screw terminals. The optocouplers and isolated DC-DC converter provide more than 500VDC isolation.

E.7.3 Switch sampling rate

The Switch Closure Interface samples the screw terminals every 5 milliseconds for an effective update rate of 200Hz. To debounce the inputs, the Switch Closure Interface requires successive events before recording data.